

# Demo: BeCasso - Artistic Image Processing and Editing on Mobile Devices

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**Figure 1:** Three results produced with BeCasso for an input image with a resolution of  $2,400 \times 1,600$  pixels (displayed cropped): cartoon (left), oil paint (middle) and watercolor style (right). The outputs are based on multi-stage, flow-based nonlinear filtering and color grading.

## Abstract

BeCasso is a mobile app that enables users to transform photos into high-quality, high-resolution non-photorealistic renditions, such as oil and watercolor paintings, cartoons, and colored pencil drawings, which are inspired by real-world paintings or drawing techniques. In contrast to neuronal network and physically-based approaches, the app employs state-of-the-art nonlinear image filtering. For example, oil paint and cartoon effects are based on smoothed structure information to interactively synthesize renderings with soft color transitions. BeCasso empowers users to easily create aesthetic renderings by implementing a two-fold strategy: First, it provides parameter presets that may serve as a starting point for a custom stylization based on global parameter adjustments. Thereby, users can obtain initial renditions that may be fine-tuned afterwards. Second, it enables local style adjustments: using on-screen painting metaphors, users are able to locally adjust different stylization features, e.g., to vary the level of abstraction, pen, brush and stroke direction or the contour lines. In this way, the app provides tools for both higher-level interaction and low-level control [Isenberg 2016] to serve the different needs of non-experts and digital artists.

**Keywords:** mobile, non-photorealistic rendering, image filtering, stylization, interaction, GPU

**Concepts:** •Computing methodologies → Image manipulation;  
•Human-centered computing → Mobile devices;

## Technical Approach

Image stylization enjoys a growing popularity on mobile devices to foster casual creativity [Winnemöller 2013]. With the limiting hardware capabilities of mobile devices, an interactive processing of high-resolution images becomes an increasingly challenging task, in particular for artistic rendering that is based on multi-stage nonlinear filtering. One approach is to shift complex processing tasks to dedicated servers and only use mobile devices for image display, which however sacrifices interactive manipulations by users.

This work presents *BeCasso*, a mobile app that implements a GPU-based, efficient image analysis and processing pipeline to realize the objective of an interactive image processing on mobile devices: (1) real-time color grading using lookup tables is employed to simulate rendering with reduced color palettes, (2) a multi-scale approach processes images on downsampled versions and performs upsampling to achieve deliberate levels of abstraction [Semmo et al. 2016], (3) graph-based processing chains of multi-stage effects are analyzed to dynamically trigger only invalidated stages, and (4) algorithms for an efficient (re-)use of textures reduce the memory footprint while maintaining rendering performance. These enhancements significantly facilitate the implementation of interactive tools to adjust filtering effects at run-time, such as toon, watercolor and oil paint (Figure 1). This is demonstrated by an on-screen painting interface for per-pixel parameterization, e.g., to locally vary the color diffusion and level of abstraction.

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